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# PATENT SPECIFICATION

689,484



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## COMPLETE SPECIFICATION

### Improvements in or relating to Heat Exchangers

We, N.V. PHILIPS' GLOEILAMPENFABRIEKEN, a limited liability Company, organized and established under the laws of the Kingdom of The Netherlands, having our seat and office at Emmasingel 29, Eindhoven, Holland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to heat exchangers having a cylindrical wall through which the heat exchange takes place. With heat exchangers of this type a medium, e.g. hot gas, passes over the exterior of the cylindrical wall and is in heat-exchanging contact, through the wall, with another medium, e.g. air, passing over the interior of the cylindrical wall. As a rule, the wall of such a heat exchanger is furnished, both externally and internally, with projecting parts, e.g. ribs. It is also known to provide a strip of material, for example, deeply corrugated at the inner side of the wall, thus forming channels for the working medium and considerably increasing the heat exchanging surface of the wall. However, these constructions have a limitation in that the provision of uniform folds in the material is comparatively difficult. In another known construction, the ribs and the wall are formed integrally by casting. This construction also has the disadvantage that a precise construction entails difficulties. The aforesaid known constructions are often used in hot-gas reciprocating apparatus, which term is to be understood to include hot-gas reciprocating engines and refrigerating apparatus according to the reversed hot-gas reciprocating engine principle.

According to the invention, a heat exchanger having a cylindrical wall through which heat exchange is to take place provided with segments jointly constituting a cylinder at the interior of the said wall throughout its interior periphery at least part of said segments being

provided with channels for the passage of one of the media exchanging heat through the wall is characterized in that all opposed side walls of the channels two of each defining one channel, extend parallel to one another in each segment. The aforesaid segments are cheaply obtainable, for instance, by extrusion, drawing or milling.

In order to ensure a satisfactory heat transfer through the wall to the segments, the interior of the cylindrical wall may be subject to surface pressure exerted by the cylinder consisting of segments. Thus, the outer diameter of the cylinder consisting of segments may slightly exceed the inside diameter of the cylindrical wall. Due to this the material of the segments becomes deformed on insertion, for example, with the use of thermal shrinking into the cylindrical wall, thus ensuring an intimate contact between the segments and the cylindrical wall.

The segments may be secured to the wall by soldering, which may be effected without the use of special tools. The soldered joint is corrosion proof, since during soldering only a small surface area of the joint is exposed to the surrounding air.

The side walls of the channels provided in the segments extend parallel to one another and terminate at a cylindrical surface thereof.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described in greater detail with reference to the accompanying drawing, given by way of example, which represents diagrammatically a hot-gas reciprocating engine comprising one embodiment of a heat exchanger according to the invention.

Figure 1 is a longitudinal section of part of the engine and Figure 2 is a section taken on the line II—II of Figure 1.

The hot-gas reciprocating engine comprises a displacer 1 and piston 2 reciprocating with a constant phase difference and connected to a driving mechanism (not

[7]

represented). The space above the displacer is the hot space 3, whereas the space between the displacer and the piston is the cold space 4. The spaces 3 and 4 are interconnected through a cooler 5, a regenerator 6, and a heater 7. The heater has a cylindrical wall 8 over the exterior of which the combustion gases pass. These gases are supplied from a burner 9 to the heater 7 and escape therefrom through a channel 10. As is shown in Figure 2, the wall 8 is provided with external ribs 11 and segments 12 are provided which are soldered to the wall and which jointly constitute a cylinder extending throughout the interior periphery of said wall, at least a part of said segments having channels 13, through which the air to be heated passes, and which terminate at the cylindrical inner surface of each segment. All opposed side walls of the channels two of each defining one channel extend parallel to one another in each segment. In order to separate the hot space from the space within the heater, a cylinder 14 is provided within the segments.

It will be obvious that the use of the heat exchanger according to the invention is not limited to hot-gas reciprocating apparatus, but may also be used in other apparatus.

What we claim is:—

1. A heat exchanger having a cylindrical wall through which heat exchange is to take place provided with segments jointly constituting a cylinder at the interior of the said wall throughout its interior periphery at least part of said segments being provided with channels for the passage of one of the media exchanging heat through the wall. characterized in that all opposed side walls of the channels, two of each defining one channel, extend parallel to one another in each segment.

2. A heat exchanger as claimed in any of the preceding claims, characterized in that the segments are secured to the wall by soldering.

3. A heat exchanger substantially as herein described with reference to the accompanying drawing.

4. A hot-gas reciprocating engine comprising a heat exchanger as claimed in any of the preceding claims.

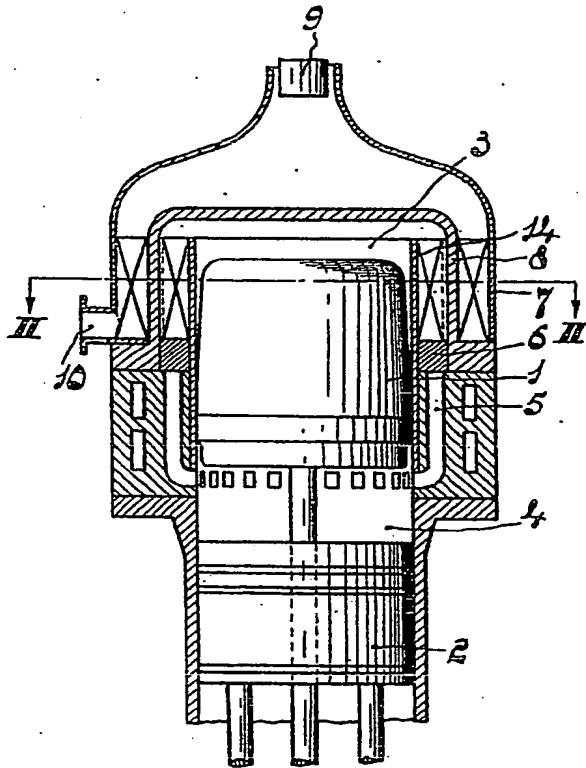
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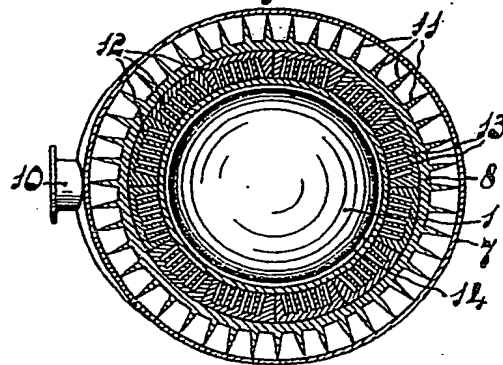
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COMPLETE SPECIFICATION

*This drawing is a reproduction of  
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*Fig. 1*



*Fig. 2*